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tion of modern science, and the present inquiry is an endeavor to bridge one of the many gaps in the continuity of knowledge that still bar our progress. If mind can be subsumed under the general term function, we are the gainers by just that correlation. We have made one further step in the integration of knowledge. The advantages which follow to philosophy from the taking of this step are being rapidly elaborated in the recent writings of the apostles of the functional school.

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REVIEWS AND ABSTRACTS OF LITERATURE

Species and Varieties, Their Origin by Mutation. Lectures delivered at the University of California by Hugo de Vries. Edited by D. T. MACDOUGAL. Chicago, Open Court Publishing Co. 1905. Pp. xviii + 847.

Since the completion, not more than two years ago, of Professor de Vries's '*Mutationstheorie*,' the appreciation of the importance of his contribution to the theories of the origin of new forms has been rapidly growing. During the summer of 1904, on invitation from the University of California, Professor de Vries delivered a series of lectures at Berkeley which, under the editorship of Dr. D. T. MacDougal, are presented in the volume before us.

The key-note of the whole book is struck in the last of the three statements, printed on one of the fly-leaves. These statements, which make a somewhat dramatic opening to the whole discussion, are as follows: 'The origin of species is a natural phenomenon,' Lamarck; 'The origin of species is an object of inquiry,' Darwin; 'The origin of species is an object of experimental investigation,' de Vries. It is in this matter of experimental investigation, perhaps, that Professor de Vries has made the most important advance and has reawakened the active interest which, despite many able workers and theorizers, had flagged since the time of Darwin. To have brought the question within the field of experimentation has brought, too, the hope that some more definite evidence can be obtained as to the mechanism of the origin of new forms. To Professor de Vries's keen reasoning, his acute observation and above all his accuracy and care of culture methods, is due the new light that he has been able to throw on this most perplexing of all problems. To maintain that his theory is complete in all respects would, of course, be the attitude of an incautious enthusiast, but at least this much can be said, the author has seen and has recorded the springing into existence of new forms of plants of sufficient difference and stability to be regarded as what we are pleased to call new species.

In discussing the origin of these new forms it is necessary to distinguish carefully what is ordinarily meant by a *species* and what should be understood by the term *variety*. This is accomplished in the chapters which lead up to the discussion of the mutation theory itself; and, while a considerable portion of the book is so occupied, the outlay of space is fully justified; for, without this, confusion would only be worse confounded.

It is first to be understood that the Linnæan or collective species are not in reality founded on single types, but rather on groups of closely similar types, and that the concept of the species as a whole is, so to say, the average impression. The forms which make up these group species are termed by de Vries *elementary species,* which differ from one another along positive rather than negative lines, and differ also in more than one quality. These elementary species may, indeed, constitute subspecies or the new species which the later, more critical taxonomists have segregated from the older group species. The existence of less fundamentally differing forms must also be recognized, and these, in the sense hereinafter stated, are the *varieties* of de Vries. These varieties differ from the type from which they have sprung in a usually retrograde direction, by the loss of some one unit character or, in rarer cases, by the reappearance of some character possessed by nearly related forms. Varieties, then, differ usually by but one character and contain no elements really new. The term as ordinarily used is, however, a somewhat loose one and no doubt includes forms which should really be relegated to the class of elementary species.

The next question considered is the behavior both of these elementary species and of these varieties in relation to their progeny. Excluding all cases of hybridism and what are afterwards termed 'ever-sporting varieties,' the cases of atavism among varieties are found to be rare. Certain well-known atavistic forms of plants are, indeed, widespread in a geographical sense, but this is due to various means of vegetative propagation and not to the recurrence of the atavisms. Including, however, the cases where hybridism may have played a part, false atavism, or '*vicinism,*' is frequently observed and is to be ascribed to the accidental and often undetected production of reversionary hybrids, and can not be attributed to any innate tendency within the organism itself.

This leads to the discussion of hybridism in general, and again the author accentuates the difference in the behavior of species and of varieties. In the case of the former the unit characters which go to make up the difference between two species do not find their mates when the forms are crossed; the qualities are impaired, and consequently the crosses may be called uni-sexual. The resulting progeny are stable, non-reverting hybrids. In crossing varieties, on the other hand, the unit characters are all present and combine in pairs and the crosses may consequently be termed bi-sexual. The resulting progeny are not stable and will in due course revert according to the principle established by Mendel. According as to whether given unit characters are active or latent one or another quality will be respectively dominant or recessive.

Having shown that atavism among varieties is of rare occurrence where the question is not complicated by hybridization, the author next considers the question of the '*ever-sporting varieties.*' By this term he means varieties of pure origin which show a tendency to sport in nearly every generation. The somewhat cumbrous term is necessitated by the loose use of the word 'sport,' as it is commonly employed by horticulturists. Numerous specific examples are treated, and a careful analysis of this 'ever-sporting' tendency is made. It appears that the phenomenon is pretty definitely limited between two extremes. As the author puts it, it is to be regarded as a mere swinging from one extreme to the other of two opposite types, which happen to be united in one race, and that the limits of the 'ever-sporting variety' are as sharply defined as in any other variety. Thus again we can not find even in this process anything which will lead to the production of really new forms.

Thus does Professor de Vries lead up to the climax, namely, the production of *mutants.* These *mutants* are new, elementary species which have arisen suddenly and without intermediate steps from the parent type, and which, when properly guarded, breed true to their new characters. To grasp the full meaning of this it is necessary to follow the line of the author's thought in detail. It is impossible here to explain how he was led to seek for forms which evinced this tendency towards the sudden appearance, not of mere varieties, but of these new elementary types, which show some positive variation from the parental form.

As is well known, Professor de Vries found in *Œnothera lamarckiana* a plant most favorable for observation, although his conclusions are not based alone on the evidence afforded by this example. In all he obtained a dozen new types, all from the original parent form, *Œnothera lamarckiana,* although some were no more than varieties. Especial attention should be called to the fact that these pedigree cultures were carried on with the greatest care to insure the purity of the offspring and to keep an unimpeachable record of the pedigree of all the plants. The author makes it plain that such precautions are a *sine qua non* for results which are to have any value; and in the light of the possibility of hasty and incorrect conclusions being drawn from less accurate work, it is of the first importance to reiterate this.

Of these mutants which have been seen to arise some are, then, evidently new species. Their line of departure from the parent type may be in almost any direction. Some, we may say, are probably destined to failure, others perhaps are better placed than the parental type and could, in time, conceivably stamp it out. Here it is that we can apply the Darwinian idea of the struggle for existence, a struggle, however, not between single individuals, but between whole groups of elementary species. By such means, as Professor de Vries maintains, the process of the evolution of new forms might take place with far greater rapidity than by the method implied in the idea of continuous variation. Whether, indeed, origin by mutation is the only way in which new species may come into being is, of course, an open question, but that they may and do arise by these sudden jumps there seems no doubt after a consideration of Professor de Vries's evidence.

Such are, in the main, the important facts presented in the book. A discussion of a general hypothesis of mutation must be in a measure speculative. One asks, what are the predisposing causes which lead to a state of mutability? Is there any periodicity in mutation periods? In fact, a host of questions, to which as yet no answer can be given, are at once suggested. It is plain that it is on the physiological side that the author expects to get the most assistance. Indeed, it is in the accentuation of the physiological as against the purely morphological point of view that he has done the greatest service towards the encouragement of research. If we are to find the stimulus which influences organic forms to mutate, if we are possibly to control the process in any way, it must be a question of the physiological and not the morphological conditions which we will have to investigate. Even though it might seem but a wild stretch of the imagination to even think of realizing such possibilities, it is plain that along the line of these and of related questions much information of the highest importance will probably be obtained.

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Zur Psychologie des Lesens bei Kindern und Erwachsenen. OSKAR MESSMER. Archiv für die gesammte Psychologie, December, 1903, Band II., Heft 2 u. 3. Pp. 190–298.

Experimentelle und kritische Beiträge zur Psychologie des Lesens bei Kurzen Expositionzeiten. ERICK BECKER. *Zeitschrift für Psychologie und Physiologie der Sinnesorgane.* Band 36, Heft 1 u. 2. Pp. 19–73.

These articles are concerned with the problems of word-perception. Becker discusses critically the earlier tachistoscopic investigations of Wundt and Zeitler and of Erdmann and Dodge, and offers experimental evidence of the correctness of the methods and conclusions of the latter that the perception of words is by means primarily of the total word-form. Messmer develops the main theories of Wundt and Zeitler of a successive apperception (in the Wundtian sense of the word) of the single elements of the word complex by means of a rapid movement or fluctuation of attention over it, and a second hypothesis of Zeitler closely connected with this, that of the so-called domineering letters.

On the basis of experiments with very short exposures of words with four adult subjects and six children of seven to eleven years of age, Messmer attempts a classification of readers into two general types, the objective and the subjective type.

In the case of the former the point of attention coincides very closely with the physiological fixation point. Long words are read only by combining single sections of small groups of letters which are successively perceived. The perception of the subjective type is, in contrast, relatively independent of the exact place of fixation. During the brief interval of exposure the attention flits back and forth within the field of view; and is thus able to fix upon long words and phrases in their entirety. If a word is placed well to the left of the point of fixation, the objective type of reader can see only the few letters lying nearest to the fixation; the subjective type, by means of this ready movement of attention, grasps